

computers & graphics

**an international journal
of systems & applications
in computer graphics**

**algorithms and techniques for interaction,
multimedia, modelling and visualization**

Editor-in-Chief

J. L. Encarnaç>o

Fraunhofer-Institut für Graphische Datenverarbeitung

List of Contents and Author Index

Volume 23, 1999

computers & graphics

Editor-in-Chief: **José L. Encarnaçao**
Fraunhofer-Institut für Graphische Datenverarbeitung,
Rundesturmstrasse 6, 64283 Darmstadt, Germany

Associate Editors: **Peter R. Bono**
President,
Peter R. Bono Associates, Inc.,
PO Box 648,
Gales Ferry, CT 06335, USA

Axel Hildebrand
ZGDV, Computer Graphics
Centre, Rundesturmstrasse 6,
D-64283 Darmstadt,
Germany

Associate Editor for
"Chaos & Graphics" Section: **Clifford A. Pickover**
IBM Thomas J. Watson Research
Center, Yorktown Heights,
NY 10598, USA

Associate Editors for
"Education" Section: **Lars Kjell Dahl**
Numerical Analysis &
Computing Sciences, NADA,
Royal Institute of Technology
KTH, S-10044 Stockholm,
Sweden

José Teixeira
Grupo de Métodos e Sistemas
Gráficos,
Dep. de Matemática - FCTUC,
Largo de D. Dinis - Apartado 3008

Editorial Advisory Board

Varol Akman Ankara, Turkey	James D. Foley Atlanta, GA, USA	Bertram Herzog Ann Arbor, MI, USA	Eiachiro Nakamae Hiroshima, Japan
Farhad Arbab Amsterdam, Netherlands	Ilio Galligani Bologna, Italy	Frederic W. Jansen Delft, Netherlands	Bernard Peroche St. Etienne, Cédex, France
Wilhelm Barth Wien, Austria	Robert K. L. Gay Singapore	Arie Kaufman Stony Brook, NY, USA	Philip K. Robertson North Ryde, Australia
R. Daniel Bergeron Durham, NH, USA	Michael Gervautz Wien, Austria	Myoung-Hee Kim Seoul, Korea	Seah Hock Soon Singapore
Ken Brodie Leeds, England	Bernd Girod Erlangen, Germany	Fumihiko Kimura Tokyo, Japan	Jiaovong Shi Hangzhou, China
Pere Brunet Barcelona, Spain	Martin Göbel Sankt Augustin, Germany	Stanislav Klimenko Potvino, Russia	Václav Skala Pizen, Czech Republic
Daniel Cohen-Or Tel-Aviv, Israel	Donald P. Greenberg Ithaca, NY, USA	Detlef Krömer Darmstadt, Germany	Wolfgang Strasser Tübingen, Germany
Brian Curless Seattle, WA, USA	Georges Grinstein Lowell, MA, USA	Marcio Lobo Netto São Paulo, Brazil	Yasuhiro Suenaga Nagoya, Japan
David Duce Chilton, Didcot, UK	Markus Gross Zurich, Switzerland	Carl Machover White Plains, NY, USA	Bodo Urban Rostock, Germany
Bianca Falcidieno Genova, Italy	Richard A. Guedj Evry Cédex/Les Epinnettes, France	Sudhir P. Mudur Juhu, Bombay, India	Shin Ting Wu Campinas, Brazil
Dieter Fellner Bonn, Germany	D. H. Müller Dormund, Germany	Tetsuo Tomiyama Tokyo, Japan	Michael J. Zyda Monterey, CA, USA

Author Service Department: For queries relating to the general submission of articles (including electronic text and artwork) and the status of accepted manuscripts, please contact the Author Service Department. *e-mail:* authors@elsevier.co.uk; *Fax:* + 44 (0) 1865 843905; *Tel:* + 44 (0) 1865 843900.

Publication information: Computers & Graphics (ISSN 0097-8493). For 2000, Volume 24 is scheduled for publication. Subscription prices are available upon request from the Publisher or from the Regional Sales Office nearest you or from this journal's website (<http://www.elsevier.nl/locate/cag>). Further information is available on this journal and other Elsevier Science products through Elsevier's website: (<http://www.elsevier.nl>). Subscriptions are accepted on a prepaid basis only and are entered on a calendar year basis. Issues are sent by standard mail (surface within Europe, air delivery outside Europe). Priority rates are available upon request. Claims for missing issues should be made within six months of the date of dispatch.

Periodicals postage is paid at Rahway, NJ. Computers & Graphics (ISSN 0097-8493) is published 6 issues per year in February, April, June, August, October and December by Elsevier Science Ltd., The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK. The US subscription price is \$1353 per year.

POSTMASTER: Send address corrections to: Computers & Graphics, Elsevier Science, Customer Support Department, PO Box 945, New York, NY 10159-0945.

Distributed in the USA by Mercury Airfreight International, 365 Blair Road, Avenel, NJ 07001.

Cover illustration based on an image from K. Kanev and T. Sugiyama, "Design and simulation of interactive 3D computer games", *Computers & Graphics* 22(2-3), 1998.



PERGAMON

Computers & Graphics 23 (1999) III-VIII

COMPUTERS
& GRAPHICS

www.elsevier.com/locate/cag

List of Contents

NUMBER 1

*In this issue the special topic is
COMPUTER GRAPHICS IN INDIA*

Guest Editor: S.P. Mudur

1 Computers & Graphics Best Paper Award

Computer Graphics in India

3 Guest Editors' Introduction

7 An architecture for the shaping of Indic texts

25 Intelligent interpretation of CADD drawings

45 Generation of multi-block topology for discretisation of three-dimensional domains

59 Zeus: surface modeling, surface grid generation, tetrahedral volume discretization

73 Advances in volume graphics

85 Object oriented design of an interactive mechanism simulation system – Clodian

95 AUTOLAY – a GUI-based design and development software for laminated composite components

Technical Section

111 Computational techniques for automatically tiling and skinning branched objects

127 A review of behavioural animation

145 Database guided computer animation of human grasping using forward and inverse kinematics

S.P. Mudur

**S.P. Mudur, Niranjan Nayak,
Shrinath Shanbhag and R.K. Joshi**

B.S. Prabhu and S.S. Pande

**Amit Shirsat, Sandeep Gupta
and Gopal R. Shevare**

**Dinesh Shikhare, S. Gopalsamy,
T. Sathi Reddy, Ashwini
Patgawkar, Satyashree Mahapatra,
S.P. Mudur, K.P. Singh,
Laxmi Ravishankar**

Swami Manohar

**Deepraj S. Dixit, Shirish
H. Shanbhag, S.P. Mudur,
Kurien Isaac and
Shirish Chinchalkar**

B.G. Prakash

Anne L. Marsan and Debasish Dutta

**R.J. Millar, J.R.P. Hanna and
S.M. Kealy**

**Yahya Aydin and
Masayuki Nakajima**

	<i>Chaos & Graphics</i>
M. Visvalingam and C.I. Brown	155 The deconstruction of teragons into decogons
Asok K. Sen	169 The product-delay algorithm: graphic design with amplitude- and frequency-modulated waveforms
	175 Past/Future Issues
	177 List of 1998 Reviewers
	179 Announcements

NUMBER 2

In this issue the special topic is

WSCG '98

Guest Editor: Václav Skala

	<i>WSCG '98</i>
Václav Skala	191 Guest Editors' Introduction
László Szirmay-Kalos and Werner Purgathofer	193 Global ray-bundle tracing with infinite number of rays
László Szirmay-Kalos, Balázs Csébfalvi and Werner Purgathofer	203 Importance driven quasi-random walk solution of the rendering equation
Young-Jung Yu, Ho-Youl Jung and Hwan-Gue Cho	213 A new water droplet model using metaball in the gravitational field
Leon Shirman and Yakov Kamen	223 A new look at mipmap level estimation techniques
Ove Sommer, Alexander Dietz, Rüdiger Westermann and Thomas Ertl	233 An interactive visualization and navigation tool for medical volume data
Yizhou Yu	245 <i>Technical Section</i> Efficient visibility processing for projective texture mapping
J. Ruiz de Miras and F.R. Feito	255 Inclusion test for free-form solids
Shouqing Zhang, Ling Li and Hocksoon Seah	269 Fine-tuning in vectorization using algebraic curves
	<i>Chaos & Graphics</i>
Sidney Fels and Kenji Mase	277 Iamascope: a graphical musical instrument
Paul Kruszewski	287 A probabilistic technique for the synthetic imagery of lightning
	295 Past/Future Issues
	296 Announcements

NUMBER 3

In this issue the special topic is
VISIBILITY — TECHNIQUES AND APPLICATIONS
Guest Editors: Y.L. Chrysanthou and D. Cohen-Or

	<i>Technical Section</i>
Paul Bao and Dan Xu	309 Complex wavelet-based image mosaics using edge-preserving visual perception modeling
Christian Sifaqui	323 Structuring user interfaces with a meta-model of mental models
M.M. Madi and D.J. Walton	331 Modeling and visualization of layered objects
Beom-Soo Oh and Chang-Hun Kim	343 Systematic reconstruction of 3D curvilinear objects from two-view drawings
Borut Žalik and Gordon J. Clapworthy	353 A universal trapezoidation algorithm for planar polygons
Marcus D. Waller, Jon P. Ewins, Martin White and Paul F. Lister	365 Efficient primitive traversal using adaptive linear edge function algorithms
A. James and A.M. Day	377 The hidden face determination tree
Antonino Gomes de Sá and Gabriel Zachmann	389 Virtual reality as a tool for verification of assembly and maintenance processes
Isabelle Icart and Didier Arquès	405 An approach to geometrical and optical simulation of soap froth
Brenda L. Mak and Al Degennaro	419 Computer graphics for art creation: cultural biases against its acceptance in education
A. Crosnier and J.R. Rossignac	429 Tribox bounds for three-dimensional objects
K.W. Chung, H.S.Y. Chan and B.N. Wang	<i>Chaos & Graphics</i> 439 Spiral tilings with colour symmetry from dynamics
Humberto Rossetti Baptista	449 A method for incremental image generation
	455 Past/Future issues
	456 Announcements

NUMBER 4

In this issue the special topic is
VIRTUAL REALITY & 3D GIS
Guest Editor: Frederik W. Jansen

	<i>Virtual Reality & 3D GIS</i>
Frederik W. Jansen	467 Guest Editor's Introduction
Arnaud De La Losa and Bernard Cervelle	469 3D Topological modeling and visualisation for 3D GIS
Tobias Hüttner and Wolfgang Strasser	479 <i>FlyAway</i> : a 3D terrain visualization system using multiresolution principles

Volker Coors, Uwe Jasnoch and Volker Jung	487	Using the Virtual Table as an interaction platform for collaborative urban planning
Rick Germs, Gert Van Maren, Edward Verbree and Frederik W. Jansen	497	A multi-view VR interface for 3D GIS
 <i>Technical Section</i>		
J.-M. Dischler, L. Mostefaoui and D. Ghazanfarpour	507	Radiosity including complex surfaces and geometric textures using solid irradiance and virtual surfaces
Hassan Ugail, Malcolm I.G. Bloor and Michael J. Wilson	525	Manipulation of PDE surfaces using an interactively defined parameterisation
Li-Gang Liu and Guo-Jin Wang	535	Three-dimensional shape blending: intrinsic solutions to spatial interpolation problems
Yu-Xin He, YaLing He and Hua Li	547	Fast and accurate determination of the spatial boundary of IFS attractors
Stephen Wang-Cheung Lam	555	Multiresolution representation of interval surfaces using subdivision wavelet transform and linear programming
Göktürk Üçoluk and I. Hakkı Toroslu	573	Automatic reconstruction of broken 3-D surface objects
G.M. Treece, R.W. Prager and A.H. Gee	583	Regularised marching tetrahedra: improved iso-surface extraction
B. Eberhardt and A. Weber	599	A particle system approach to knitted textiles
 <i>Chaos & Graphics</i>		
Julyan H.E. Cartwright	607	Newton maps: fractals from Newton's method for the circle map
Jeffrey P. Dumont, Flynn J. Heiss, Kevin C. Jones, Clifford A. Reiter and Lisa M. Vislocky	613	Chaotic attractors and evolving planar symmetry
	621	Past/Future Issues
	622	Announcements

NUMBER 5

In this issue the special topic is
VISIBILITY — TECHNIQUES AND APPLICATIONS
Guest Editors: Y.L. Chrysanthou and D. Cohen-Or

Yiorgos L. Chrysanthou and Daniel Cohen-Or	633	<i>Visibility — Techniques and Applications</i> Introduction
C. Saona-Vázquez, I. Navazo and P. Brunet	635	The visibility octree: a data structure for 3D navigation

Craig Gotsman, Oded Sudarsky and Jeffrey A. Fayman	645	Optimized occlusion culling using five-dimensional subdivision
Boaz Nadler, Gadi Fibich, Shuly Lev-Yehudi and Daniel Cohen-Or	655	A qualitative and quantitative visibility analysis in urban scenes
Dirk Bartz, Michael Meißner and Tobias Hüttner	667	OpenGL-assisted occlusion culling for large polygonal models
Subodh Kumar, Dinesh Manocha, William Garrett and Ming Lin	681	Hierarchical back-face computation
A. James Stewart	693	Computing visibility from folded surfaces
Franklin S. Cho and David Forsyth	703	Interactive ray tracing with the visibility complex
Thomas A. Funkhouser	719	A visibility algorithm for hybrid geometry- and image- based modeling and rendering
Roger Hubbold and Martin Keates	729	Landmarking for navigation of large models
Paul Kruszewski	739	<i>Chaos and Graphics</i> An algorithm for sculpting trees
Joel I. Weichsel	751	Pattern formation under various tiling rules
	763	Past/Future Issues
	764	Announcements

NUMBER 6

In this issue the special topics are

AUGMENTED REALITY

Guest Editors: A. Hildebrand
& M. Gervautz

IMC '98 — SELECTION OF PAPERS

Guest Editors: B. Urban
& T. Kirste

**Axel Hildebrand and
Michael Gervautz**

Augmented Reality
Guest Editors' Introduction

**Tobias Höllerer, Steven Feiner,
Tachio Terauchi, Gus Rashid and
Drexel Hallaway**

777 Exploring MARS: developing indoor and outdoor user interfaces
to a mobile augmented reality system

**Ronald Azuma, Jong Weon Lee,
Bolan Jiang, Jun Park,
Suya You and Ulrich Neumann**

787 Tracking in unprepared environments for augmented reality
systems

Klaus Dorfmüller

795 Robust tracking for augmented reality using retroreflective
markers

Frank Seibert

801 Augmenting reality by using uncalibrated optical tracking

Thomas Auer and Axel Pinz

805 The integration of optical and magnetic tracking for multi-user
augmented reality

Anton Fuhrmann, Gerd Hesina, François Faure and Michael Gervautz	809	Occlusion in collaborative augmented environments
Reinhold Behringer, Steven Chen, Venkataraman Sundareswaran, Kenneth Wang and Marius Vassiliou	821	A distributed device diagnostics system utilizing augmented reality and 3D audio
G. Klinker, D. Stricker and D. Reiners	827	Optically based direct manipulation for augmented reality
Michael Wimmer, Markus Giegel and Dieter Schmalstieg	831	Fast walkthroughs with image caches and ray casting
Bodo Urban and Thomas Kirste	839	<i>IMC '98</i> Guest Editors' Introduction
C. Freytag and L. Neumann	841	Resource adaptive WWW access for mobile applications
Alexander Schill, Sascha Kümmel, Thomas Springer and Thomas Ziegert	849	Two approaches for an adaptive multimedia transfer service for mobile environments
Uwe Rauschenbach and Heidrun Schumann	857	Demand-driven image transmission with levels of detail and regions of interest
Bengt-Olaf Schneider and Ioana M. Martin	867	An adaptive framework for 3D graphics over networks
W. Pasman, A. van der Schaaf, R.L. Lagendijk and F.W. Jansen	875	Accurate overlaying for mobile augmented reality
Keith Cheverst, Keith Mitchell and Nigel Davies	883	Design of an object model for a context sensitive tourist GUIDE
Albrecht Schmidt, Michael Beigl and Hans-W. Gellersen	893	'There is more to context than location
Esteban Chavez, Rüdiger Ide and Thomas Kirste	903	Interactive applications of personal situation-aware assistants
Chaim Goodman-Strauss	917	<i>Chaos & Graphics</i> Dodecafoam and substitution tilings
Paul W. Carlson	925	Two artistic orbit trap rendering methods for Newton M-set fractals
	933	Past/Future issues
	934	Announcements

